

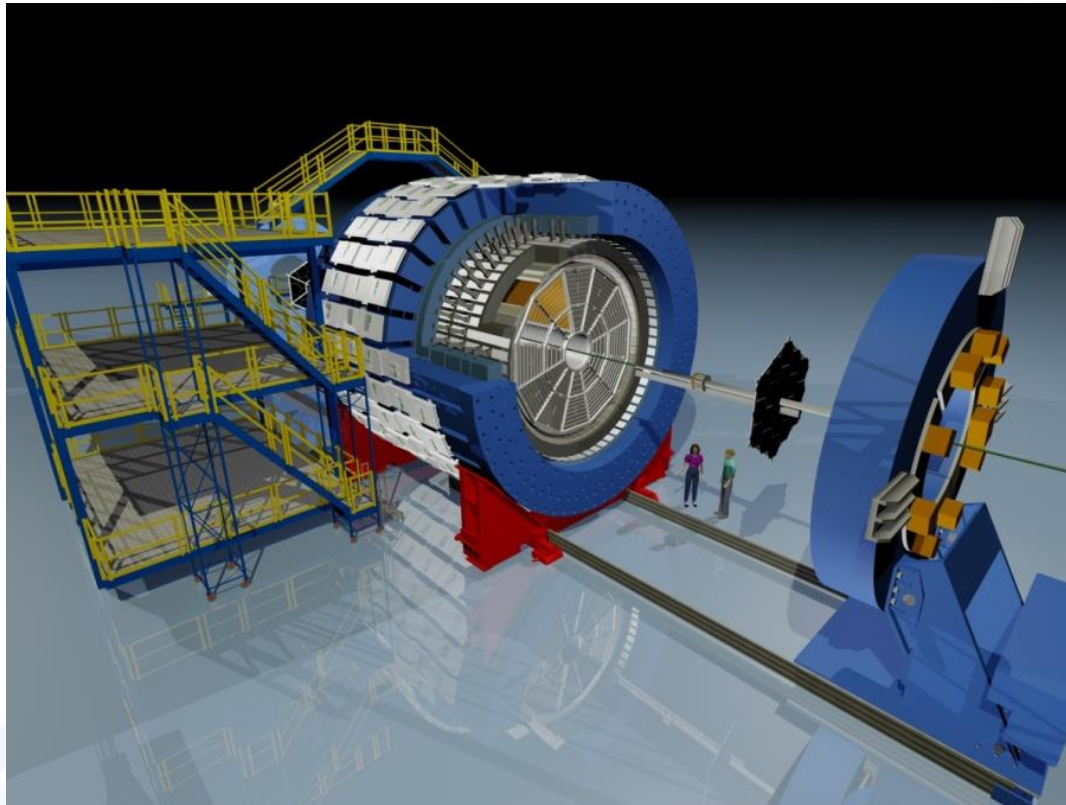
# *STAR REPORT FOR THE FIRST TIME MTG OF RUN 15*

*Bill Christie  
For the STAR Collaboration  
January 13, 2015*

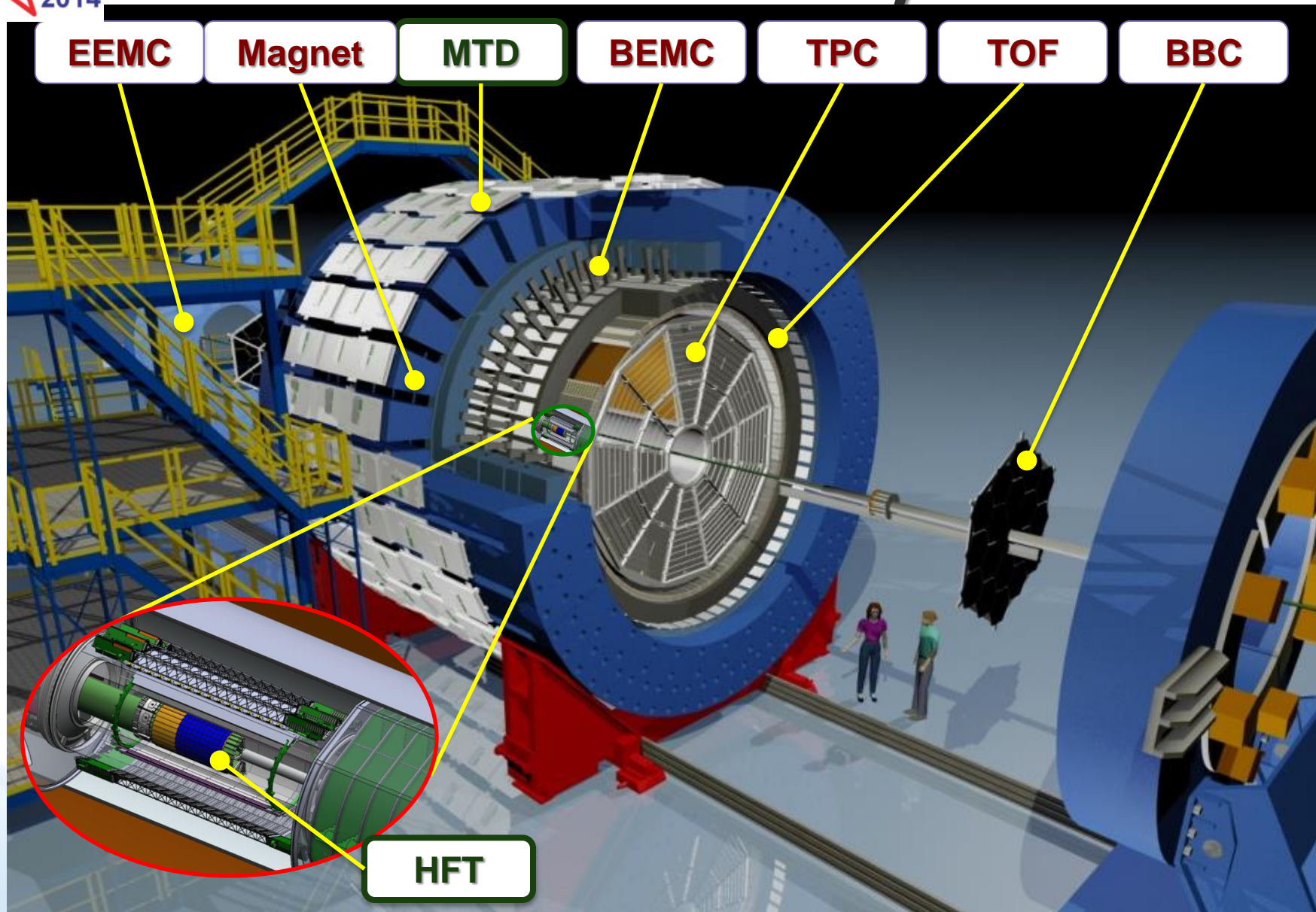


# Outline

- Data Set goals for Run 15
- New/enhanced detector sub systems for Run 15
- Summary



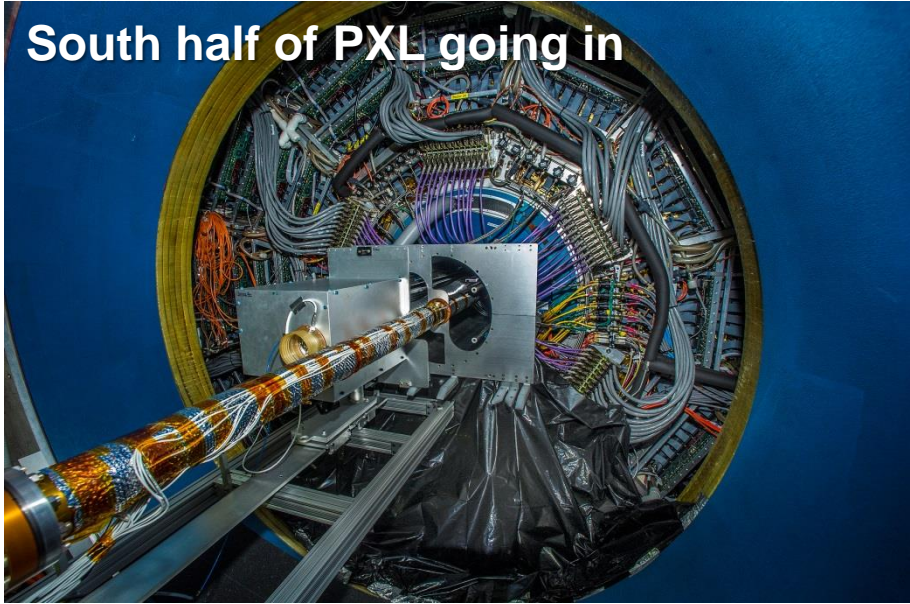
# STAR Detector System



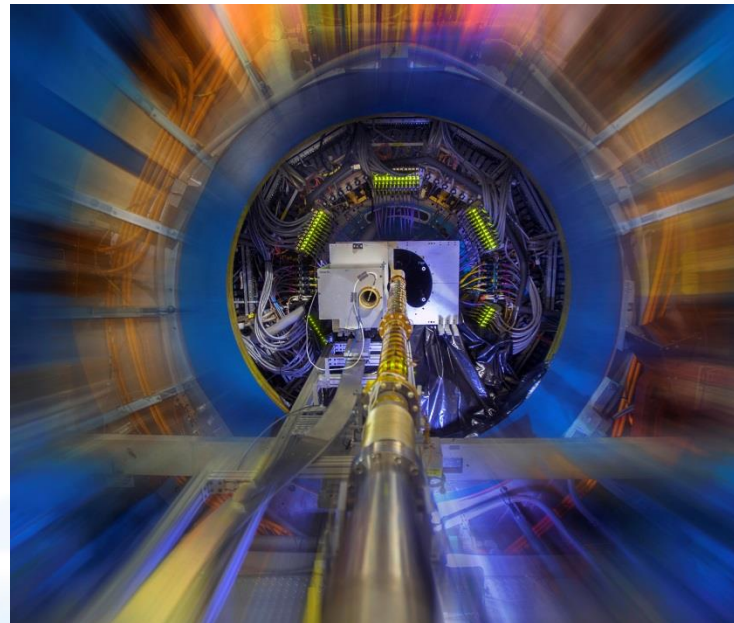
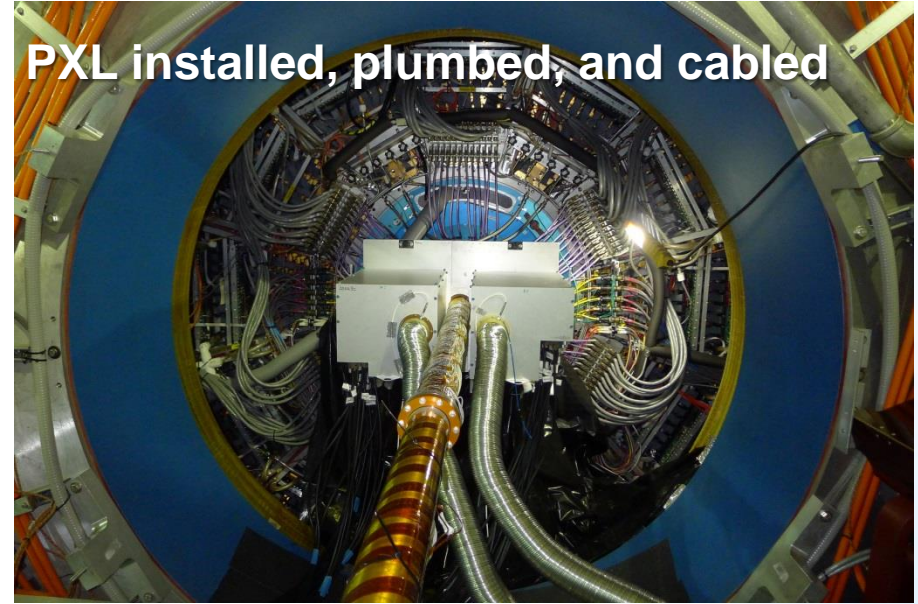


## PXL Re-installed, plumbed for air, and cabled December 15 – 17th

South half of PXL going in



PXL installed, plumbed, and cabled



Artsy Picture courtesy of Joe Robino, BNL Photography

# STAR EXECUTIVE SUMMARY

(FROM 2014 PAC MTG)

Run	Energy	Duration	System	Goals	priority	sequence
15	$\sqrt{s_{NN}}=200\text{GeV}$	5-week	Transverse p+Au	saturation physics, ridge and reference, $L=300\text{ nb}^{-1}$	1	3
	$\sqrt{s}=200\text{GeV}$	12-week	1) p+p	1) HI reference $L=90\text{ pb}^{-1}$ , 500M MB	2	2
			2) transverse 6 weeks	2) Study transversity, Sivers effects $L=40\text{ pb}^{-1}$ , 60% pol.		
			3) longitudinal 6 weeks	3) Study $\Delta g(x)$ $L=50\text{ pb}^{-1}$ , 60% pol.	2	1
16	$\sqrt{s_{NN}}=200\text{GeV}$	10-week	Au+Au	$\Lambda_c$ , $D$ , $v_2$ , $R_{AA}$ , $Y$ $10\text{nb}^{-1}$ , 2billion MB	1	1
	$\sqrt{s}=510\text{GeV}$	7-week	Transverse p+p	$A_N$ of $W^\pm$ , $\gamma$ , Drell-Yan, $L=400\text{ pb}^{-1}$	2	2

# PAC Recommendation for Run 15 Collider Operation

For Run 15 the PAC recommends the following (in *order of priority*):

- 9 weeks of polarized p+p collisions at  $\sqrt{s} = 200 \text{ GeV}$ , and
- 5 weeks of p+Au collisions at  $\sqrt{s} = 200 \text{ GeV}$  with transverse polarization of the proton
- 2 weeks of p+Si (Al) collisions at  $\sqrt{s} = 200 \text{ GeV}$  with transverse polarization of the proton

For Run 15, in a 22 cryo-weeks scenario, both p+p, p+Au and p+Si running are recommended. In the case of a shorter run, the p+p and p+Au programs would have higher priority.

**12 wks of pp requested drops to 9 wks**  
**7 wks of pAu drops to 5 wks**

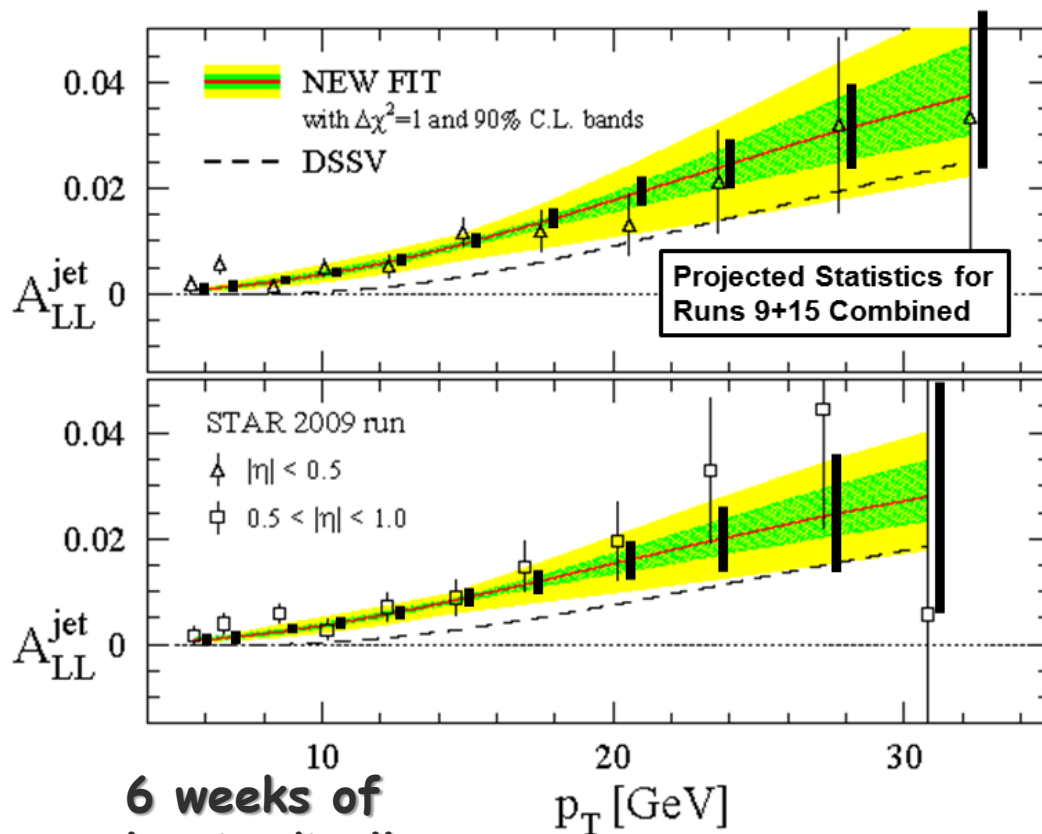
STAR Plan for the pp running is to:

- start with 5 weeks of longitudinally polarized beams
- followed by 4 weeks of transversely polarized beams.

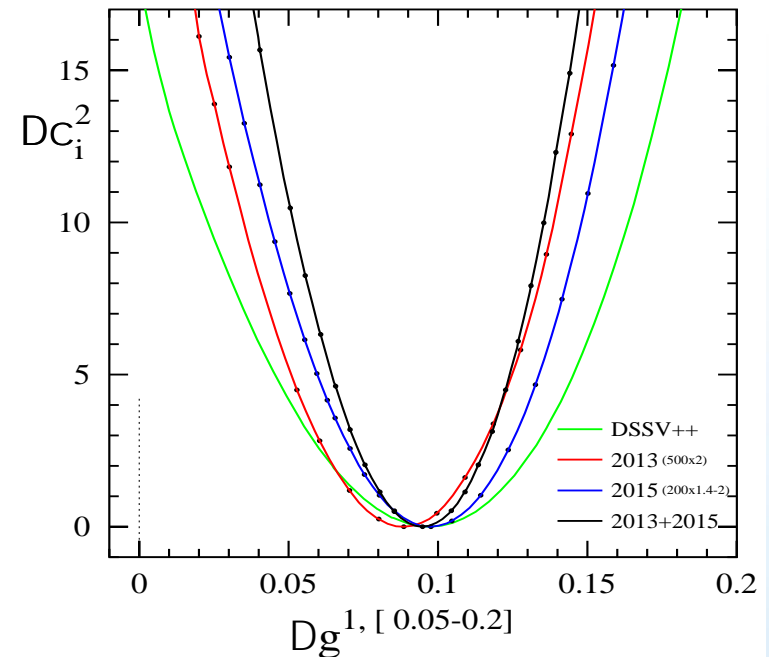
We'll use time, as/if needed, during the longitudinal running to complete commissioning of the FMSps, FMS, and pp2pp sub systems.



# LONGITUDINAL SPIN RUN15 PROJECTIONS



6 weeks of  
longitudinally  
polarized Study  $\Delta g(x)$   
 $L=50 \text{ pb}^{-1}$ , 60% pol.



The improvement of the  $\chi^2$  profile for the integrated gluon contribution in the  $x$  region currently probed at RHIC for  $\sqrt{s} = 200 \text{ GeV}$  (DSSV fit). And projections with existing and proposed datasets

factor  $\sim 2$  reduction in  $\int \Delta g(x, Q^2)$  in the 200 GeV  $x$ -range

# RUN15 TRANSVERSE SPIN GOALS

6 weeks of transversely polarized:  
Study transversity, Sivers effects,  
 $A_N$  direct photon  $\rightarrow$  Sivers ftn.  
 $L=40 \text{ pb}^{-1}$ , 60% pol.

Preshower for FMS:  
photon\_survival  $\geq 0.98$   
hadron\_survival  $\leq 0.02$

Track matching FMS/PS1,2

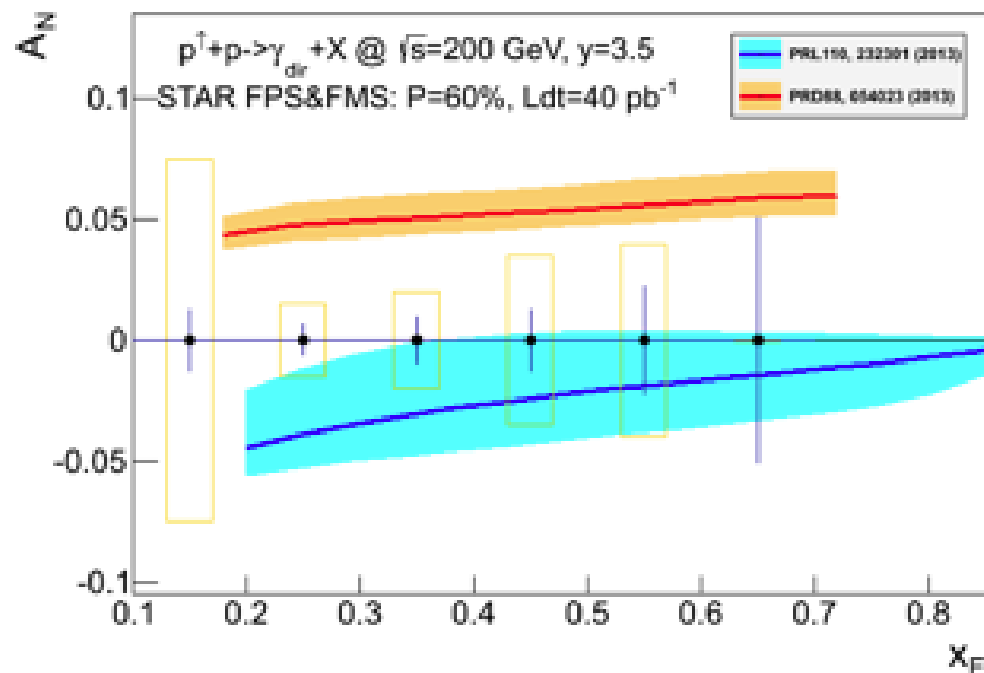
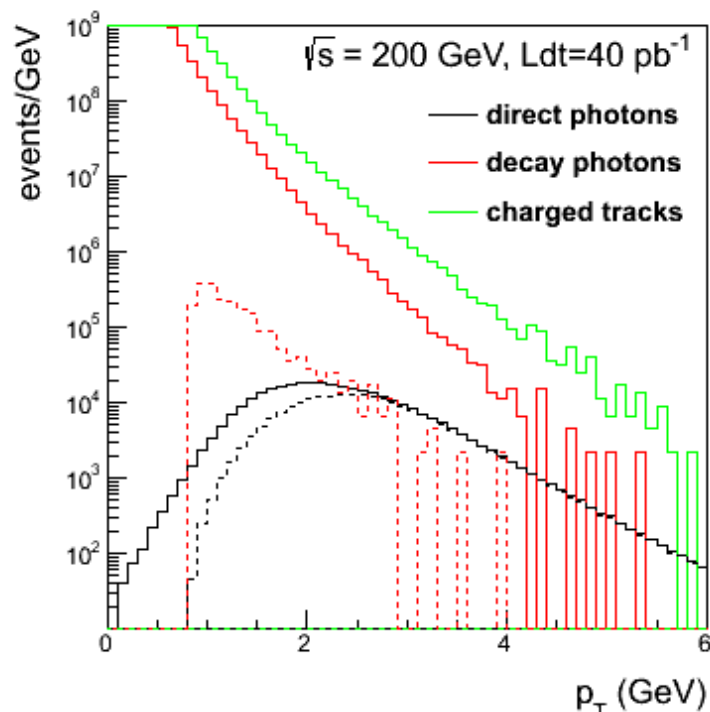
$n_{cluster} = 1$  (above 1 GeV)

$E_{cl} > 15.0 \text{ GeV}$

$p_T > 2.0 \text{ GeV}$

For systematic uncertainty:

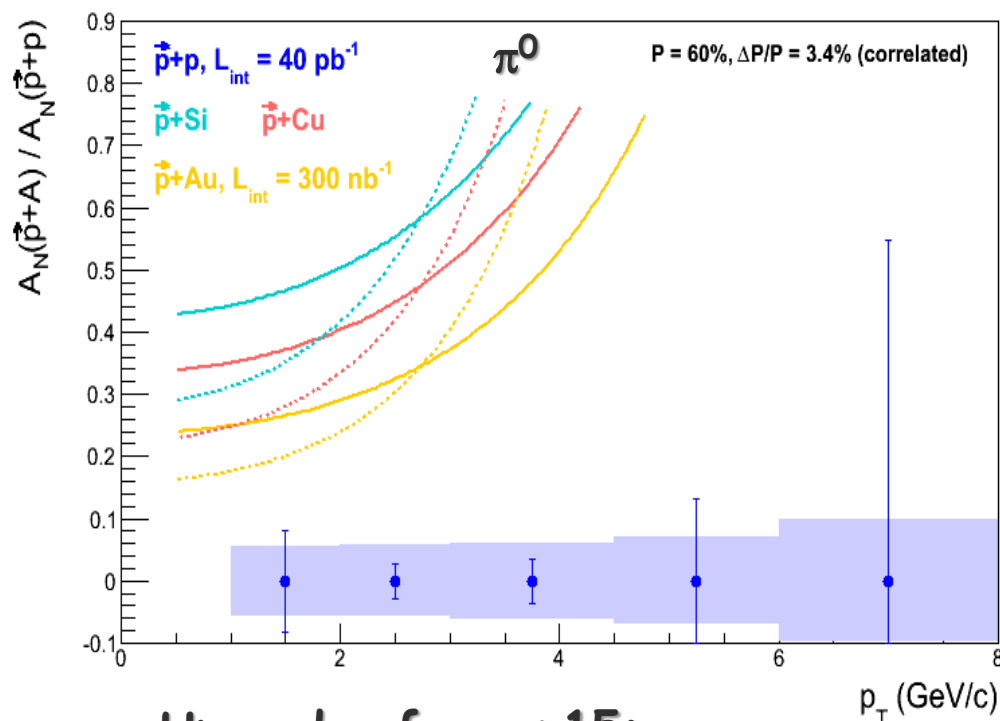
$A_N(\pi^0, \eta) \approx \max(A_N(\pi^0))$





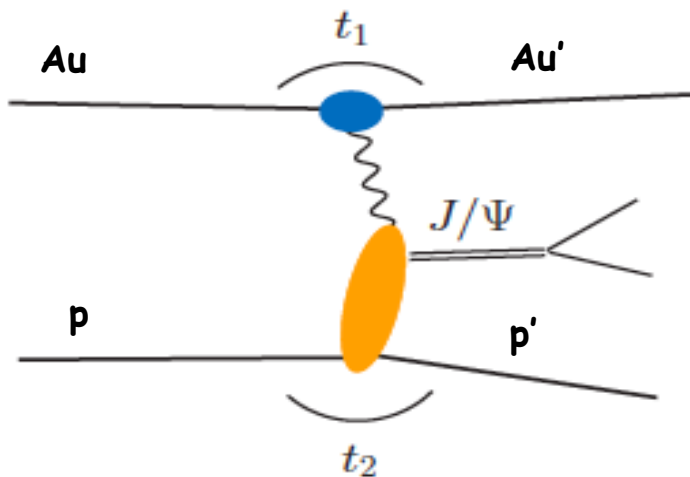
# HEAVY-ION MEETS SPIN (RUN15)

- ☐ 5 weeks  
Polarized p+Au  
 $L=300\text{nb}^{-1}$
- ☐ Saturation physics,
- ☐ pA-ridge
- ☐ Cold Nuclear Effect
- ☐ GPD gluon (pre-EIC)

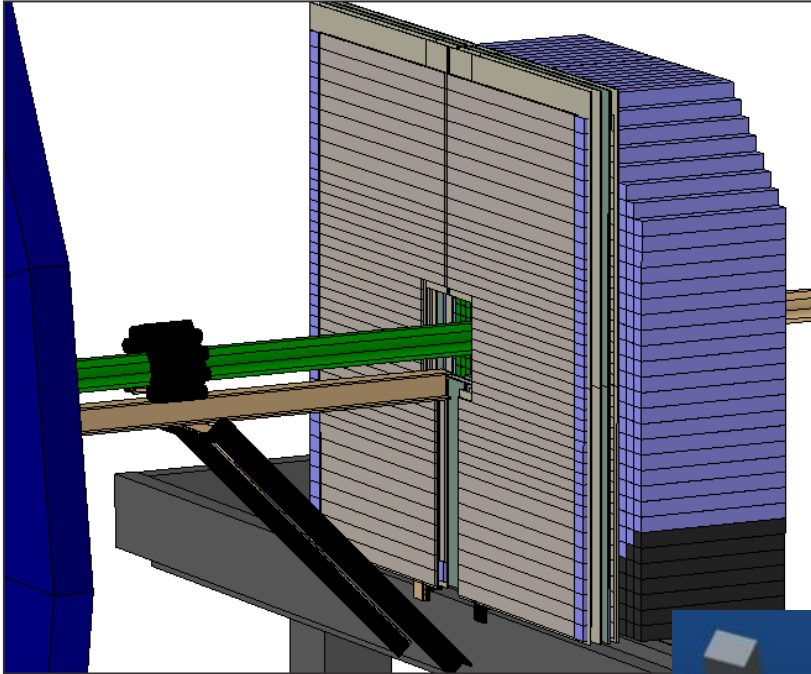


## Upgrades for run15:

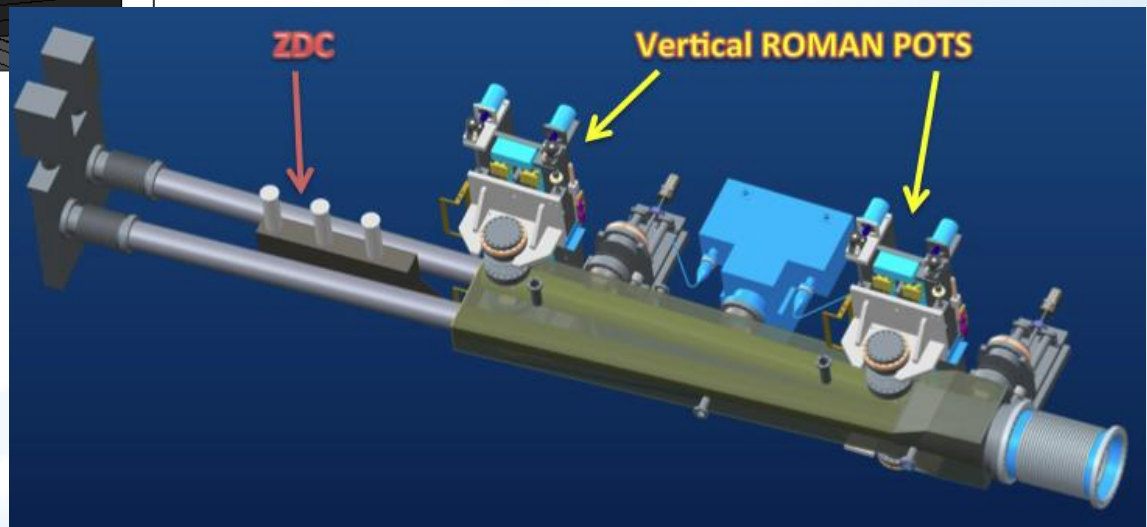
1. Roman-Pot Phase II  
(move RP closer)
2. Refurbish FMS
3. FMS pre-shower
4. Forward Instrumentation  
(proton in **BLUE**)



# New Detector capabilities for Run 15.



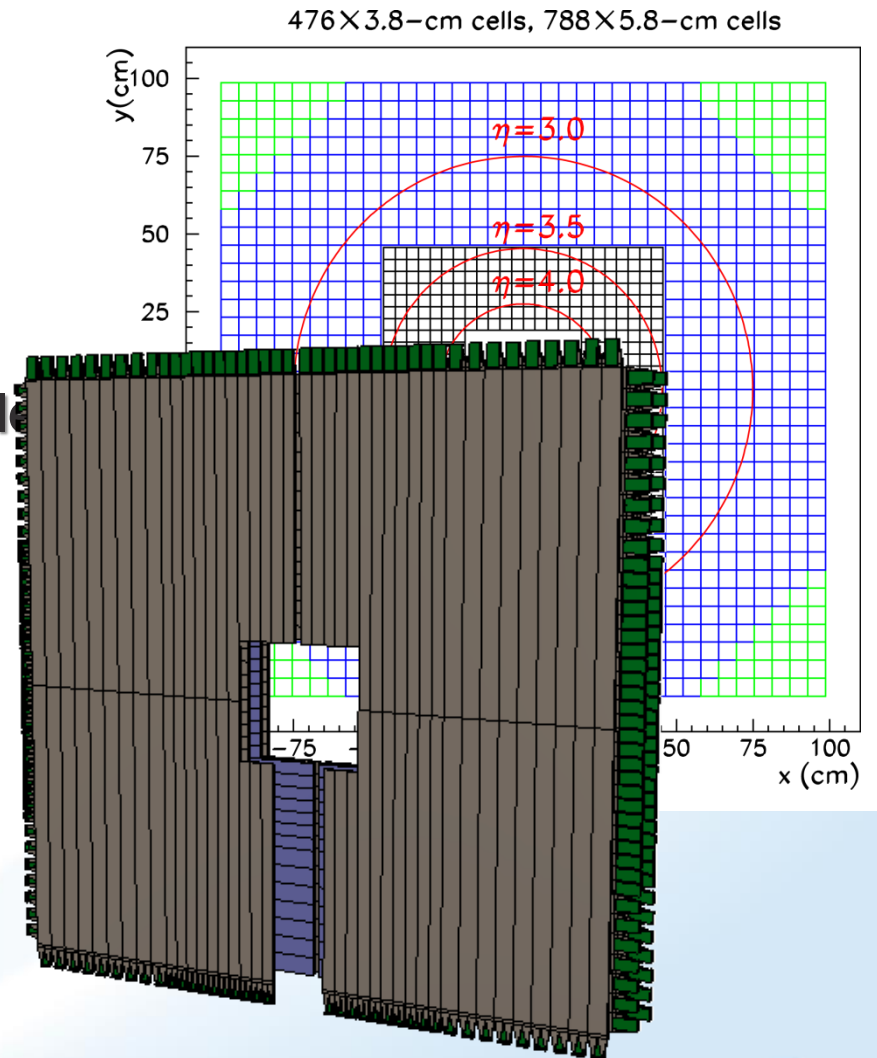
- FMS pre shower detector
- Refurbished FMS
- Pp2pp phase II



# Preshower Layout

11

- **Scintillator hodoscope**
- **Match FMS granularity**
  - Two perpendicular layers of scintillator bars
- **Photon identification**
  - Reject minimum ionizing particle (charged hadrons/leptons)
- **Electron identification**
  - Converter with additional scintillator layer
- **SiPMT readout**

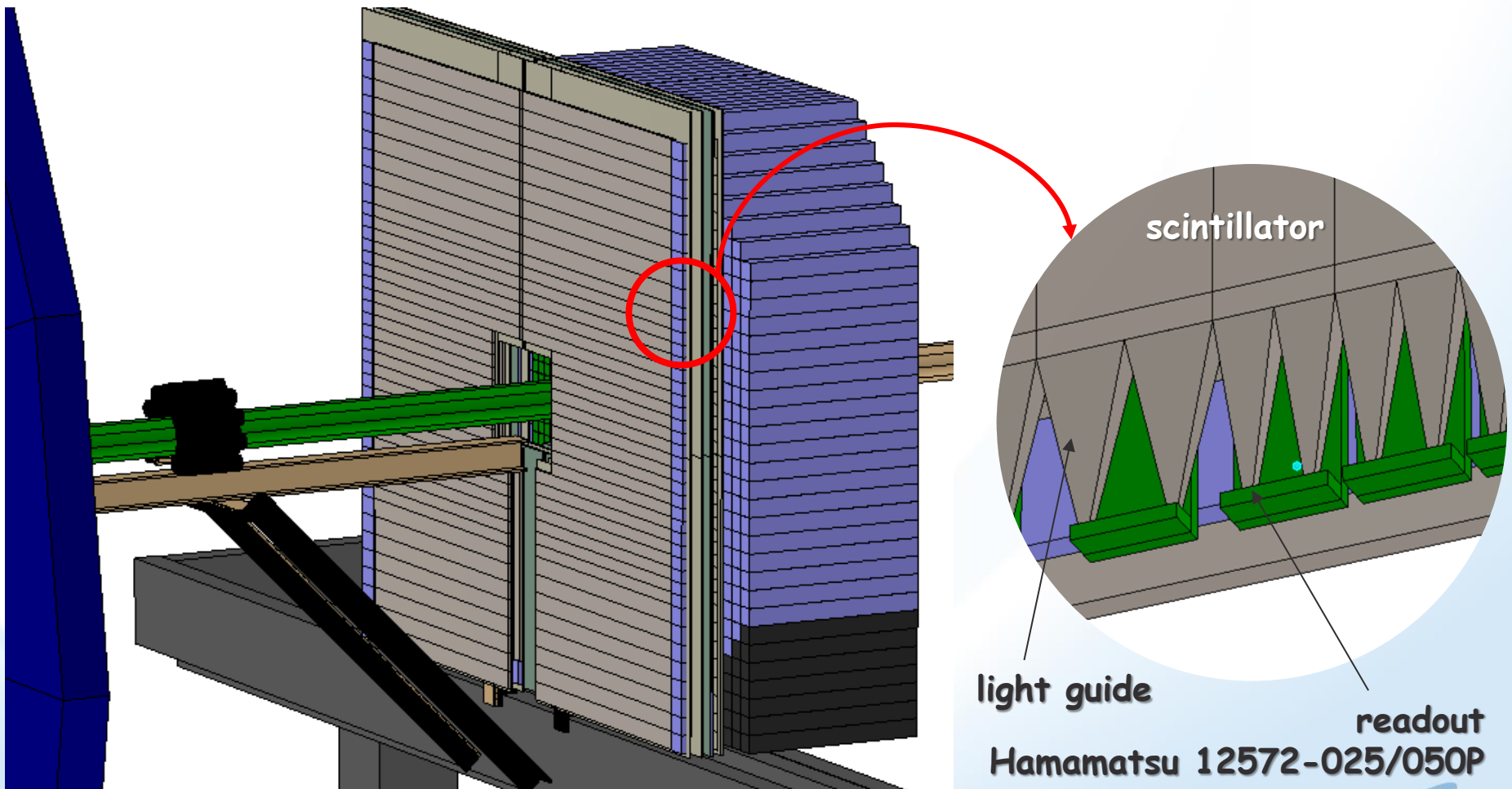




# Preshower Layout

12

as in StarVMS/Geometry/FpdGeometry



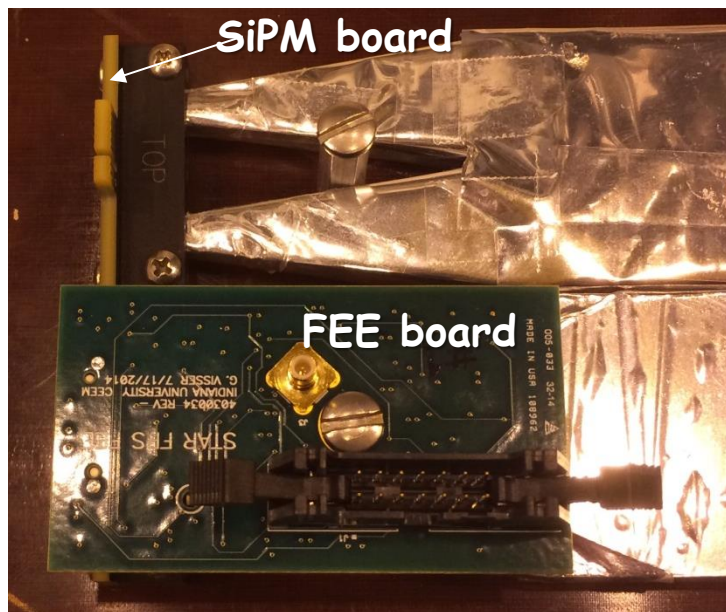
*Courtesy of Oleg Eyser*

Brookhaven Science Associates

**BROOKHAVEN**  
NATIONAL LABORATORY

# Light Guide Alignment

13

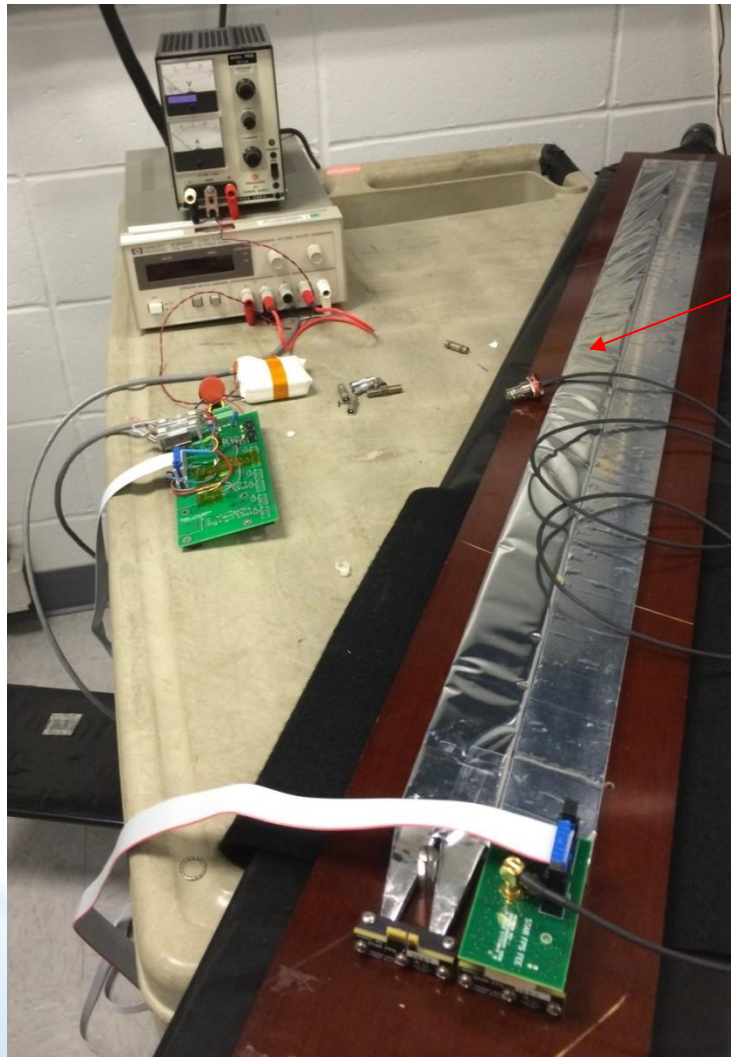


SiPM loading on board  
tolerance:  $\Delta x, \Delta y < 3 \text{ mil}$   
(x-ray measurement)

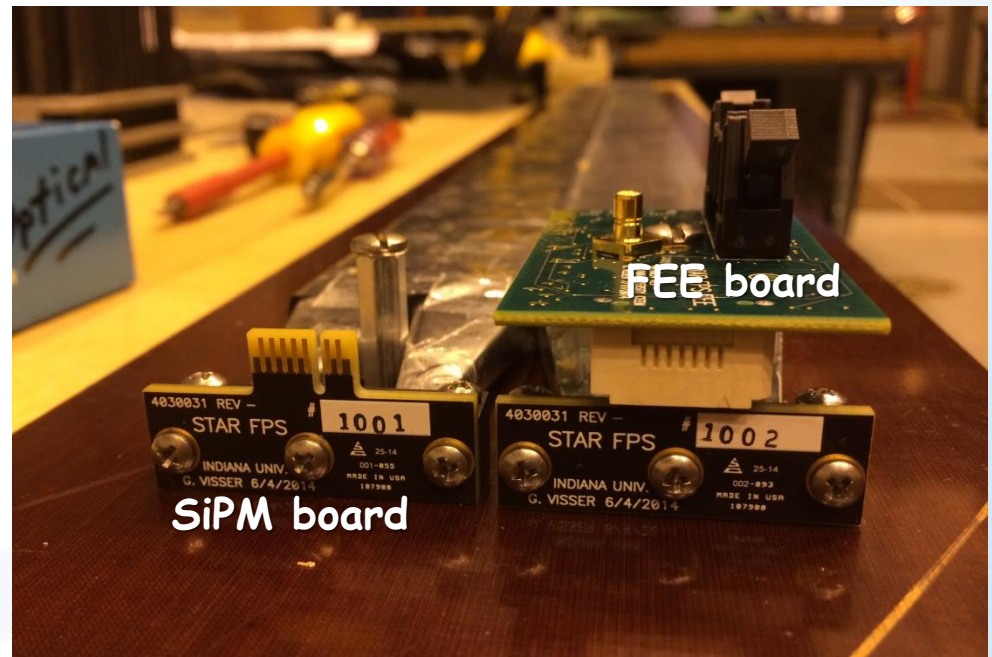


# Test Setup in Lab 1-231

14



Aluminized mylar wrap

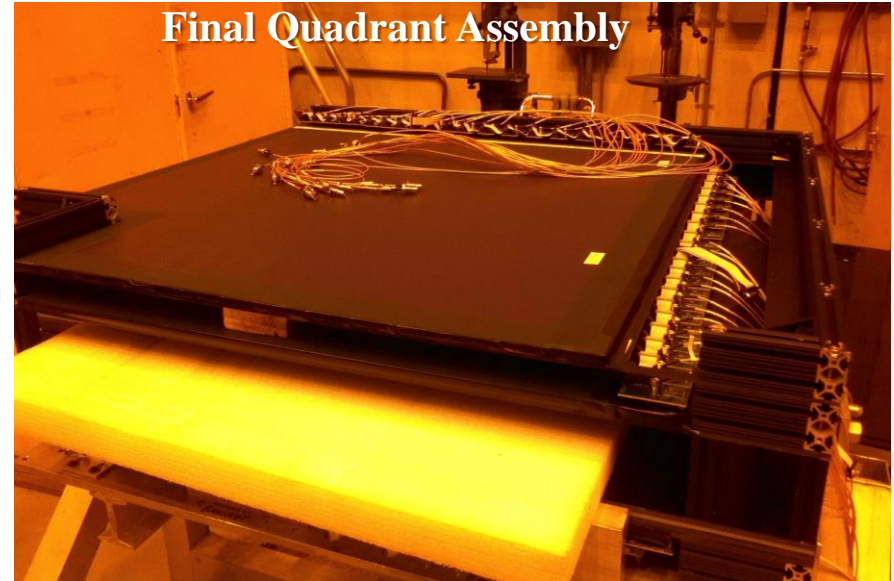




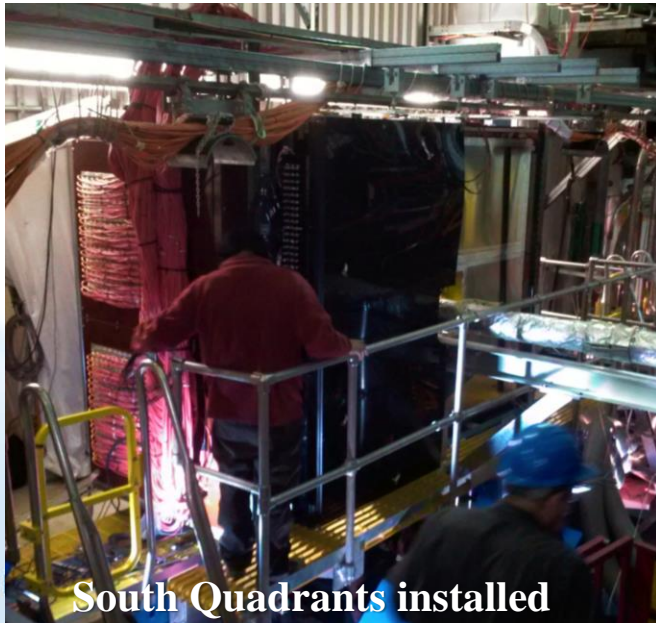
# FMS PRE SHOWER (FMSPS)



Installing FEE Boards



Final Quadrant Assembly



South Quadrants installed

## FMS consists of:

- three layers (planes) of plastic scintillator, wrapped in aluminized mylar
- glued to FR4 sheets
- one ~6 mm layer of a painted Pb sheet
- Aluminum frame
- Readout is via SiPMTs, feeding a FEE board
- then into STAR QT digitizer electronics.



# The Forward Meson Spectrometer

(FMS slides all courtesy of Grant Webb's UIC talk)

2 m

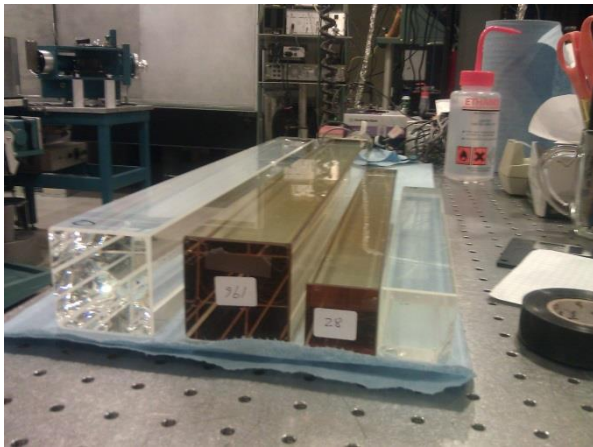
1264 Pb-glass cells

788 large cells

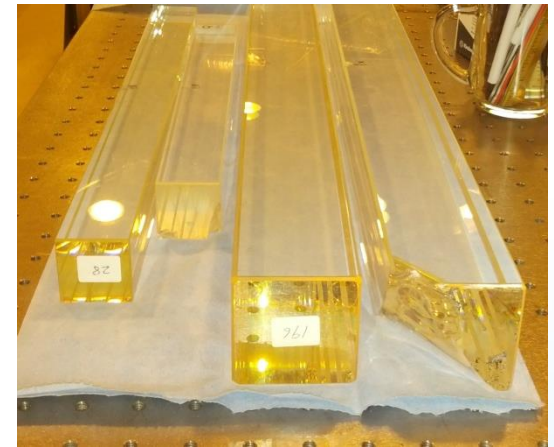
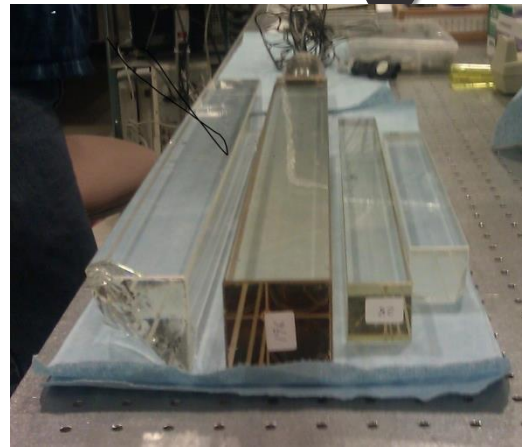
476 small cells



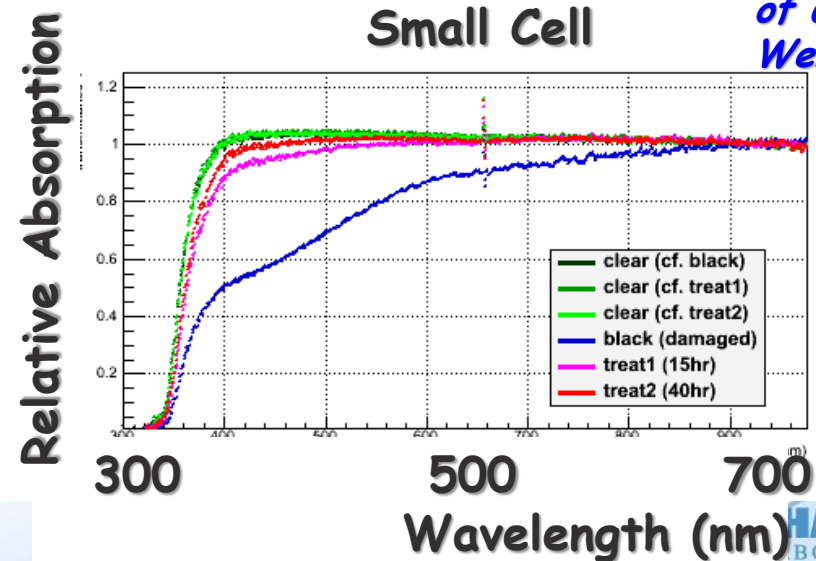
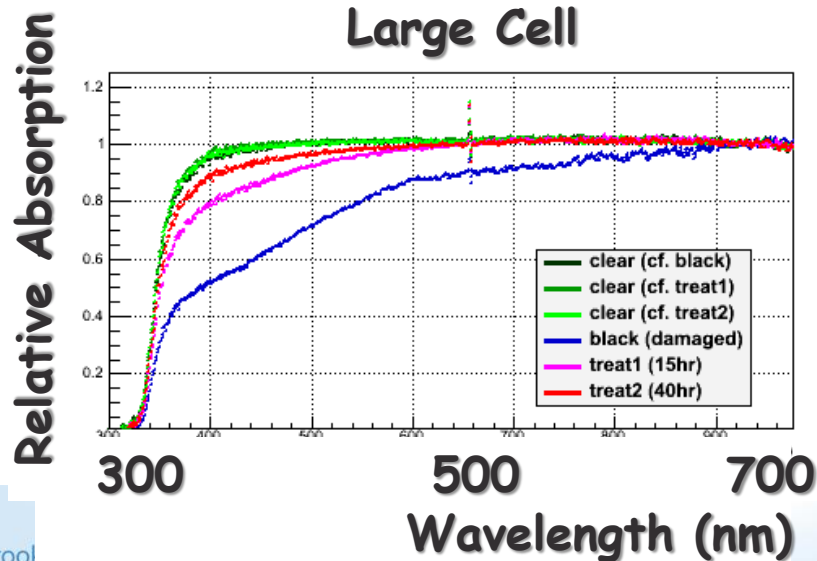
# Radiation Damage/Exposure to Sunlight



0 hours



15 hours



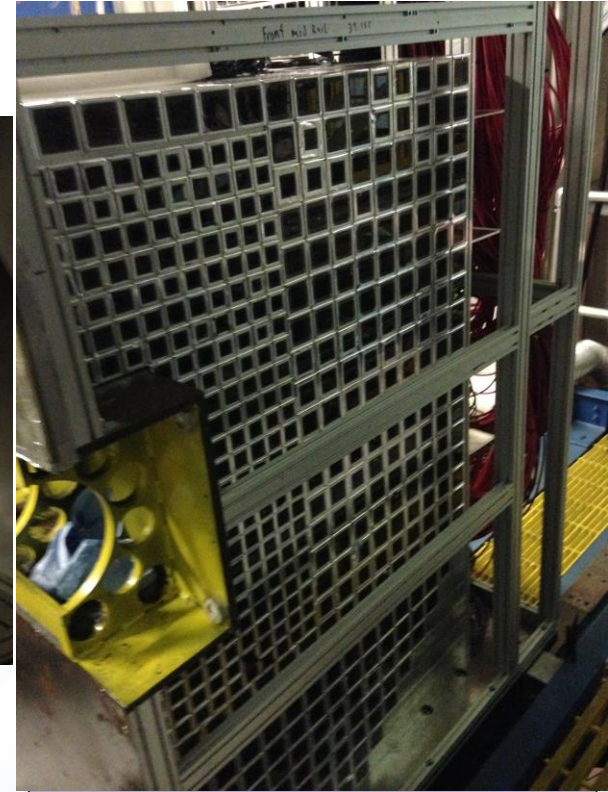
*Courtesy  
of Grant  
Webb*



# Stacking the FMS



The first cell is stacked!

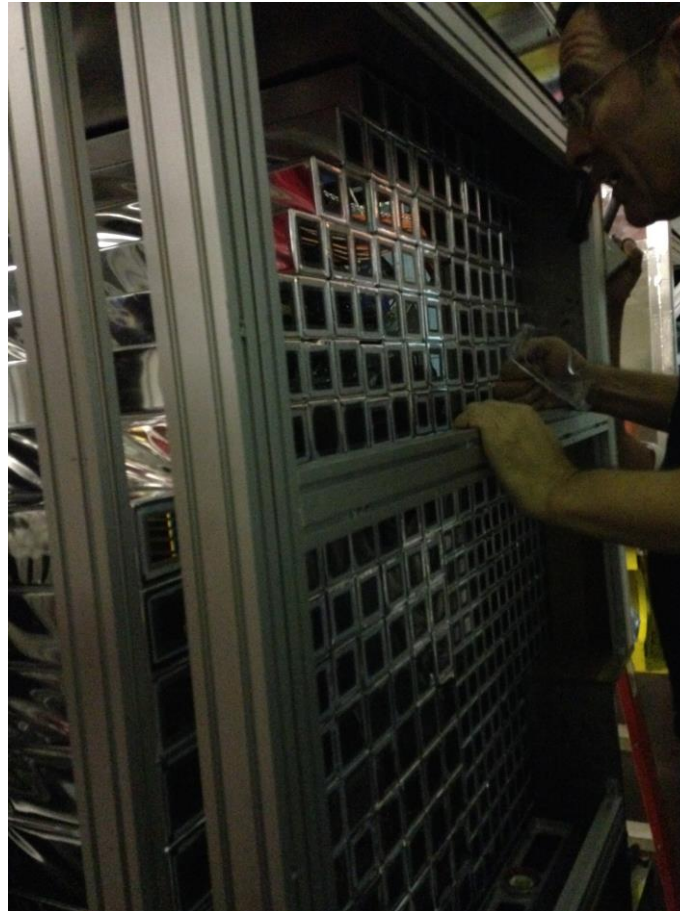


All the small cells are stacked

# Stacking the FMS



Survey of FMS  
location completed



The South Side  
Fully Stacked

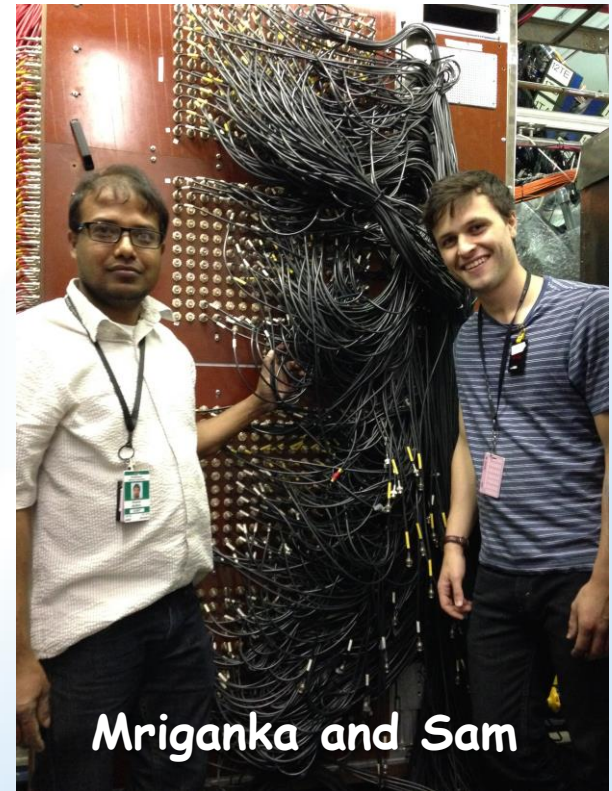


# Cabling the FMS

Attaching the HV Cables



Attaching the Signal Cables



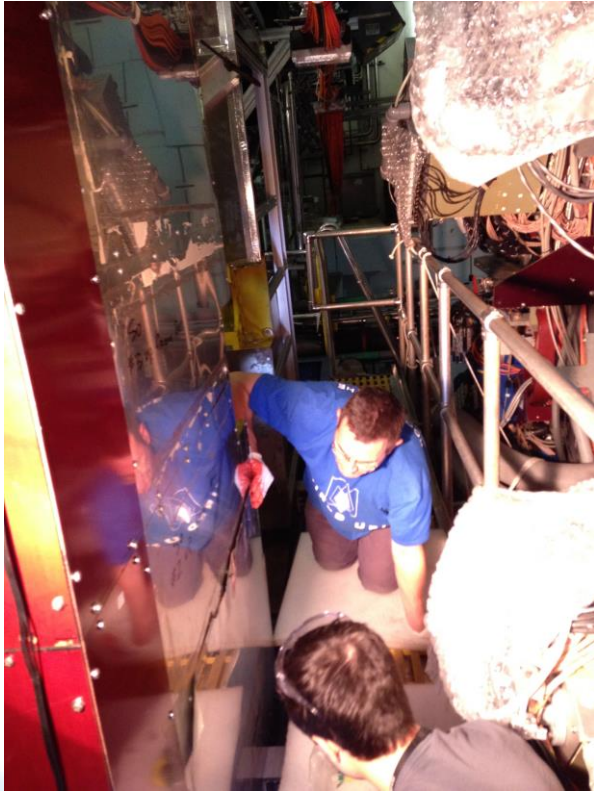
Mriganka and Sam

*Courtesy of Grant Webb*

Brookhaven Science Associates



# Making it Light Tight



Stephen & Grant



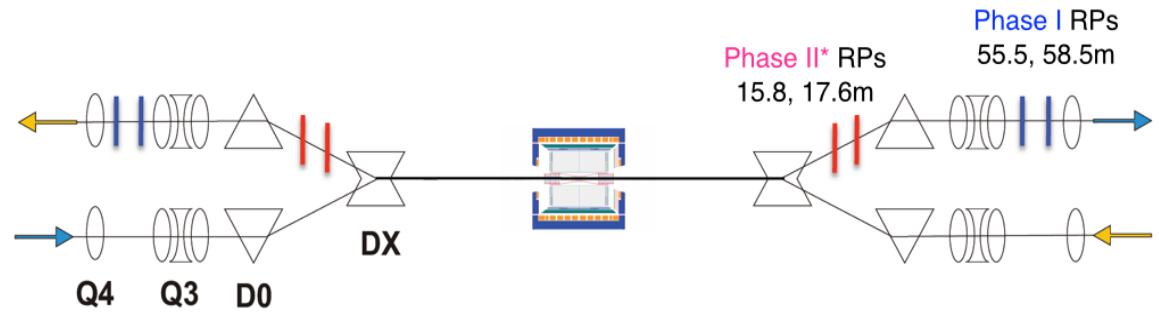
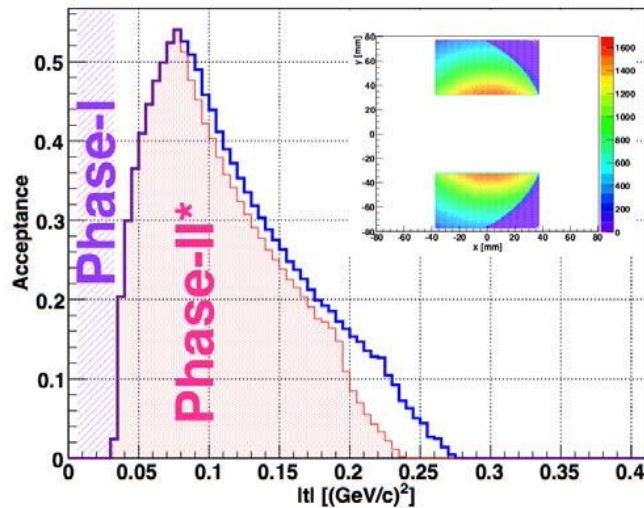
Reproducing the same shielding to make it light tight

2-3 layers of Mu metal

*Courtesy of Grant Webb*

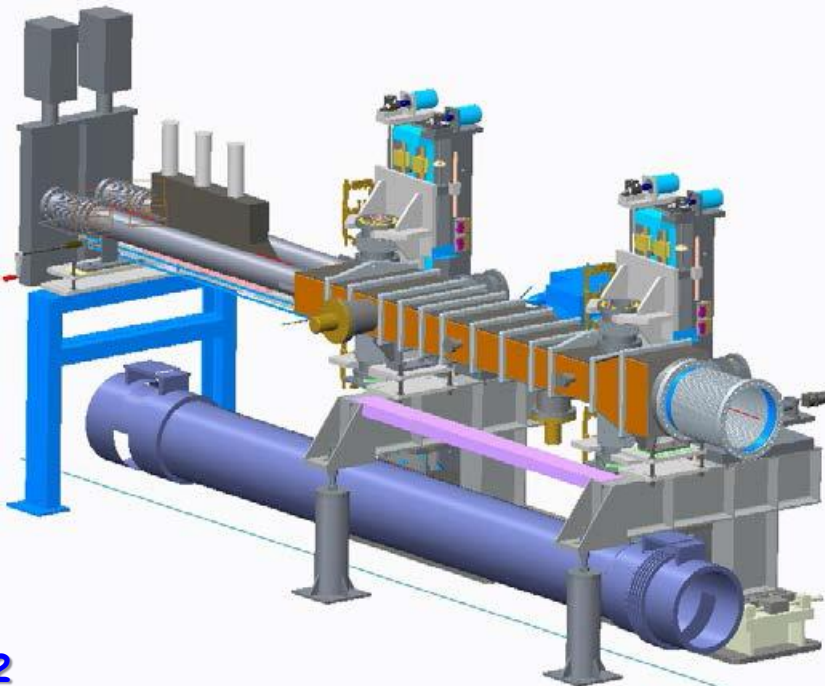
# ROMAN POT PHASE II\* (RUN15)

*Pp2pp slides courtesy of Wlodek Guryn via Robert Pak in VIC talk*

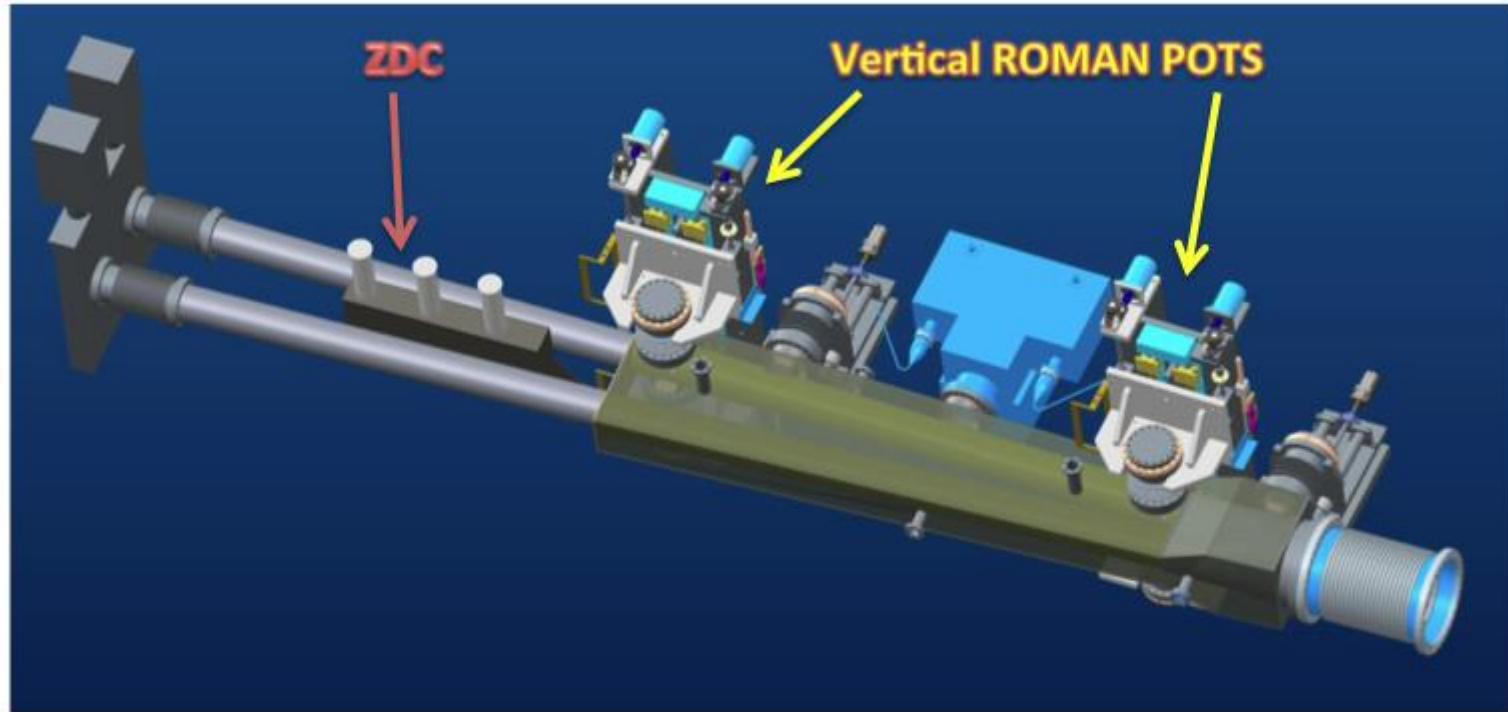


- Will allow taking data without special accelerator conditions,
- Required new vacuum chamber in DX-D0 region
- Uses Roman Pot system and detectors of pp2pp
- $A_N$  for diffractive processes
- Exotic states

Design accommodates horizontal RPs to allow spectator proton tagging for future  $p^\uparrow D$  and  $p^\uparrow \text{He}^3$  collisions.



# Roman Pot in DX-D0 Region



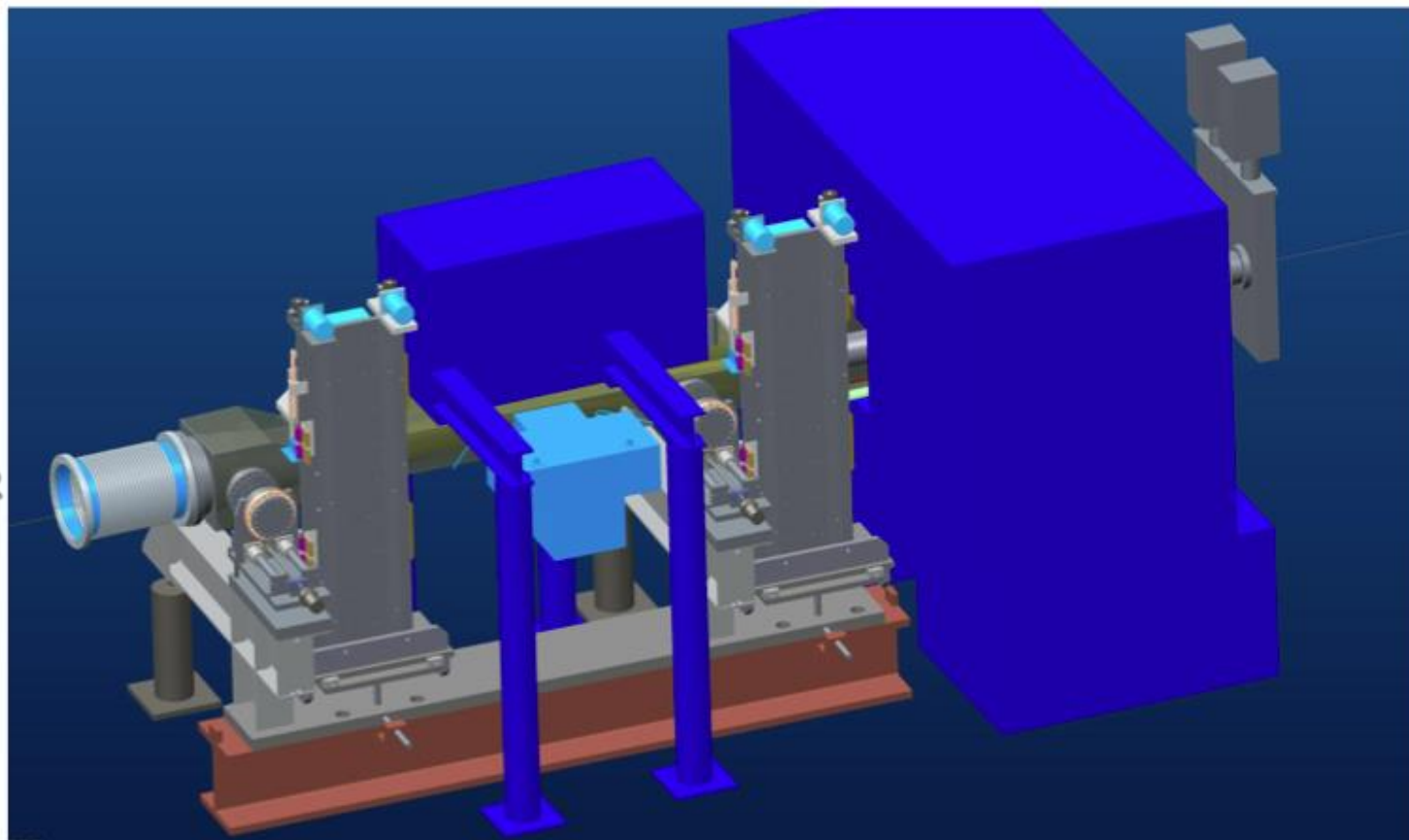
The Roman Pots of STAR are located on the outgoing beam 5 o'clock and 6 o'clock  
Two vertical station allow approach of the beam from above and below  
**to about 15 - 20 mm from the beam axis**

10/2/14

Włoddek Guryń BNL



# Roman Pot in DX-D0 Region with shielding



Note change of shielding configuration



# First DX-D0 chamber is ready for installation



The new vacuum chambers are now installed on both sides of STAR

# SUMMARY

- In addition to maintenance on all systems, re-installed the PXL, re-installed the FMS, fabricated and installing the FMS\_ps, and installing the pp2pp system for Run 15.
- STAR is starting 2 person shifts now, and will go to 4 person shifts on February 3<sup>rd</sup>. Will be taking Cosmic ray data until beam operations start.
- Still to be done, final heat run of magnet, installation of BBCs, final 2 (of 4) FMS\_ps quadrants, installation of West pp2pp detectors and pp2pp checkout.
- STAR will be ready for the scheduled Run 15 cool down to start on January 20th. Will start with longitudinally polarized beams.

Last but not least, a big THANK YOU from STAR to C-AD for all of your efforts and assistance over the shutdown to help us get our tasks completed on schedule in preparation for Run 15!